

**ABSTRACT**

Blood processing systems and related methods place first and second fluid pressure actuated pump stations in in-line communication between a source and a destination. The systems and methods apply fluid pressure pump strokes to the first and second pump stations to convey fluid from the source to the destination. The systems and methods switch between a first flow mode and a second flow mode. In the first flow mode, the pump strokes draw a fluid volume into the first pump station from the source and expel a fluid volume from the second pump station to the destination. In the second flow mode, the pump strokes draw a fluid volume into the second pump station from the source and expel a fluid volume from the first pump station to the destination. The systems and methods synchronize the pump strokes so that fluid flow from the source is essentially continuous while fluid flow to the destination is pulsatile.